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THE EXTERNAL MORPHOLOGY OF THE PRIMITIVE TANYDERID DIPTERON PROTOPLASA FITCHII O. S., WITH NOTES ON THE OTHER TANYDERIDÆ[1]

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INTRODUCTION

The purpose of this thesis is to furnish a complete description of the external anatomy of one of the most primitive representatives of the order Diptera, *Protoplasa fitchii* O. S., and to summarize the literature dealing with the family Tanyderidæ; in addition, to present a revised key to the genera of this family.

The material for morphological study consisted of alcoholic and dried specimens kindly furnished by Dr. G. C. Crampton and dried specimens from the collection of Dr. C. P. Alexander. With the exception of two of the Tanyderid wings which have been figured, all of the wash drawings were made from wing mounts contained in Dr. C. P. Alexander's unrivaled crane-fly collection.

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family Tanyderidæ was made possible through the kindness of Dr. C. P. Alexander who loaned the writer wing mounts from his extensive collection and, in addition, generously granted the use of his complete literature on the group. To him the author is indebted for his criticism of this thesis and his aid in the revision of the key to the genera.

EXTERNAL MORPHOLOGY

GENERAL APPEARANCE.

The adult of *Protoplasa fitchii* O. S. is predominantly grayish-brown in color, is relatively slender and measures about eight millimeters in length. The head is gray tinged with black and the sixteen-segmented antennæ are smoky gray-brown with a blackish tinge. The large, black, compound eyes are of particular interest because they have many short setæ arising between the ommatidia causing a "hairy-eyed" condition which is characteristic of the Tanyderids. The most conspicuous structures of the head are the long, brown, maxillary palpi which lie at the sides of the proboscis. Except for three faint brown stripes on the prescutum and the pale scutellum, the thorax is gray tinged with black. The wings are about eight millimeters in length and are striking in appearance due to the pattern which is composed of three bands of ring-like brown spots with paler brown centers. A supernumerary crossvein present in cell M_3 of the wing is the character which distinguishes *Protoplasa fitchii* from all other members of the family. The halteres are rather inconspicuous, pale, with brown clubs. The legs are long and slender and are yellowish-brown except the distitarsus and the distal portions of the femur and tibia which are dark brown. They have short, rather sparse setæ and conspicuous tibial spurs. The abdomen is brown with the posterior margins of the segments pale. The dististyles of the male hypopygium are bifid and have several strong setæ at the tip of the inner margin of the longer process.

HEAD.

There are no distinguishing sexual differences in the head and mouthparts of *Protoplasa fitchii,* so that the head of the male here figured will serve to illustrate the parts for both sexes.

In general the head is irregular in outline but the region of the head capsule behind the fronto-clypeus is subglobose. The occiput *ocp* is the part of the head capsule immediately behind the compound eyes *e* and dorsad of the occipital foramen *of* (Figs. 1, 2, and 4). On each side of the occiput there is a small structure called the occipital condyle *occ* which provides a point of articulation of the head with the laterocervicale *lc* possibly facilitating a nodding movement.

The occipital foramen *of* shown in Fig. 4 is the posterior opening of the head capsule through which the alimentary tract and nerves pass caudad into the thorax. Dorsally and laterally the occipital foramen is bounded by "chitinized thickenings" *th* which Peterson (1916) believes "arise from the ental surface of the paraocciput, a narrow piece about the dorsal and lateral margin of the occipital foramen." Figs. 3 and 4 indicate that these thickenings extend into the region of the gular pits *gp*.

Cephalad of the occiput in the dorsal region of the head is the vertex *v* (Fig. 1) which extends forward between the compound eyes to the posterior limits of the antennal fossæ. In its anterior portion the vertex is curved convexly. On the area behind the antennal fossæ are two protuberances (Figs. 1 and 2) which are more pronounced in some individuals of the species than in others.

The lateral margin of the antennal fossa bears a small projecting portion, the antennifer *anf* (Figs. 1 and 2) which is roughly triangular in shape and serves as pivot for the antenna. The anterior margin is bordered by the narrow gena *ge*.

The fronto-clypeus *fc*, an irregularly shaped sclerite cephalad of the genæ and the antennal fossæ, is formed by the fusion of the frons and clypeus. This portion of the head capsule is strongly curved and apparently serves as a shield for the bases of the mouthparts which are situated directly ventrad of it. Anteriorly the fronto-clypeus is bordered by the labrum *l*. The sclerotization of the labrum is reduced to a rather slender and indefinite medial portion while the remaining area is membranous. The labrum extends between the maxillary galeæ and is closely associated with the epipharynx.

The ventral regions behind the compound eyes *e* are the postgenæ *pge*. Between the postgenæ is the membranous gular region on each side of which is a gular pit *gp*.

Fig. 3 shows the head capsule with the dorsal portion removed to expose the internal structures. The tentorium *tnt* is reduced to two slender rods which probably represent the fused anterior and posterior arms. These rods extend from the gular pits or the mouths of the invaginations forming the posterior arms into the region of the fronto-clypeus.

APPENDAGES OF THE HEAD.

Antennæ. Osten-Sacken (1859) in his original description of *Protoplasa fitchii* recorded the antennæ as having fifteen segments. Alexander (1927b) states that they are sixteen-segmented. Fig. 7 clearly shows the scape, pedicel, postpedicel and thirteen flagellar segments, totaling sixteen. The scape *sca* is a relatively short and wide segment with a projection which serves as a pivot for the second segment, the subglobose pedicel *pd*. The postpedicel *ppd* is subovoid. With the exception of the terminal segment of the flagellum, the remaining segments are subcylindrical and vary in width, thereby appearing to taper somewhat. The terminal segment, however, is more slender than the preceding ones.

Mouthparts. The mouthparts include the labium, maxillæ, hypopharynx, and epipharynx; the mandibles are lacking.

As is shown in Fig. 9 there is no trace of a sclerotized gula and submentum. The mentum *mn* is reduced to a small and weakly sclerotized area which merges with the surrounding membrane. The sclerite labelled "*pgr*" is formed by the uniting palpigers. However, the fusion of the palpigers is not complete because the sclerites are still separated by a suture.

As in Mecoptera, the labial palpi are two-segmented. Together, the two segments form the labellum *lbl*. The basal segments are separated by membrane and are termed the basilabellum *bl*. The distal segments which form the distilabellum *dl* are weakly sclerotized with their inner margins membranous.

In comparison with the slender labium of *Tanyderus* (figured by Crampton, 1925b) that of *Protoplasa* is relatively short and stout and lacks the ligula or united glossæ and paraglossæ. The mentum of *Tanyderus* is definite, elongate, and well sclerotized. The underlip of *Macrochile* is also elongate and has a definite and well sclerotized mentum.

The maxillæ lie at the sides of the labium with the well developed maxillary palpi *mxp* extending some distance beyond the distilabellum (Figs. 6, and 9). These palpi are composed of five segments, the first of which is subglobular in shape; the succeeding two segments are subequal in length, while the fourth is shorter. The terminal or fifth segment is the longest and is rounded at the tip. Between the maxillary palpus and the basilabellum is the maxillary galea *ga* which is blade-like and extends forward a distance equaling the length of the distilabellum. A small sclerite labelled "*pfr*" which lies between the first segment of the palpus and the stipes probably represents the palpifer. The stipes *sti* is extremely long and slender extending caudad nearly to the region of the gular pits.

Ventrad of the labrum-epipharynx and closely associated with it is the hypopharynx *hp* (Fig. 8). As is shown in Fig. 8, the hypopharynx is lance-shaped and is divided into a distal, unpaired, median piece and a proximal paired area (Peterson, 1916). According to Peterson (1916), the salivary duct *sd* enters the proximal end of the hypopharynx just dorsad of its attachment to the labium and extends through it to its distal end.

The epipharynx *ep* (Fig. 5) is attached laterally to the membranous area of the labrum and is composed of a sclerotized median piece and lateral sclerotized pieces. Peterson termed these lateral structures "tormæ" *to.* The bases of the tormæ have a hinge-like connection with the basipharynx.

The basipharynx *bp* (Fig. 8) or the fulcrum is a sclerotized tube-like structure. It is closely associated with the basal portions of the epi- and hypopharynx and Peterson (1916) believes that it is formed by the fusion of the basal regions of these two structures. The posterior part of the basipharynx is extended to form two projections called the "cornua" *cu.* In the membranous region between these projections the oesophagus *oes* opens anteriorly.

THORAX.

The thorax of *Protoplasa fitchii* has been figured by Crampton (1925a and 1926b). In his 1926 publication he also includes figures of the thoraces of the Tanyderid genera *Macrochile, Tanyderus,* and *Péringueyomyina,* and in general the thoraces of these genera bear a striking resemblance to one another. The prothorax and metathorax are greatly reduced while the mesothorax or wing-bearing segment is large to accommodate the muscles of flight. The metathorax bears the halteres.

Neck Region. The walls of the membranous neck region which is cephalad of the prothorax are strengthened by two large plates, the laterocervicalia *lc* (Fig. 10). In *Protoplasa* these plates are relatively short and broad. In *Tanyderus,* however, they are long and slender, thereby forming an extremely long neck region. *Macrochile* and *Péringueyomyina* have small laterocervicalia which are more or less closely associated with the prothorax. The neck of *Protoplasa* is intermediate between the long-necked condition of *Tanyderus* and the shorter one of *Macrochile* and *Péringueyomyina.* On its anterior border the laterocervicale has a ventral finger-like projection, the cephaliger *ce* (Fig. 2), which articulates with the occipital condyle of the head. Its posterior border reaches the prothorax. A ventral view (Fig. 6) shows that each laterocervicale has a small and nearly elliptical, membranous area which has been called the "laterocervical fenestra" *lcf* (Crampton, 1925c).

Prothorax. The pronotum *pn* or dorsal area of the prothorax is divided into the antepronotum *apn* or anterior portion and the postpronotum *ppn* or posterior portion. The postpronotum is the restricted area between the prescutum of the mesothorax and the membrane surrounding the mesothoracic spiracle. The prothoracic pleuron is composed of an episternum *es* or anterior sclerite and an epimeron *em* or posterior sclerite. Dorsally the episternum *es* is fused with the antepronotum although its dorsal limit is the region of the notch into which the dorsal part of the laterocervicale fits. The epimeron *em* is demarked from the episternum by an indistinct suture and extends dorsad from the region of the coxa to fuse with the postpronotum. The sternum of the prothorax is demarked into a presternum, basisternum and furcasternum. The presternum is the most anterior and is a small ovate sclerite lying between the caudal limits of the laterocervicalia. Between the prothoracic coxæ and caudad of the presternum is the basisternum which is rather small and nearly square. The furcasternum is shield-shaped with the anterior portion lying in the area between the coxæ and its posterior portion extending caudad between the ventral limits of the mesothoracic sternopleura. The coxa cx_1 is subcylindrical and about equals the size of the eucoxa of the mesothorax or the coxa of the metathorax.

Mesothorax. The mesothoracic spiracle *sp* lies in the membrane between the postpronotum and the anterior division of the mesothoracic anepisternum. In the mesonotum the prescutum, scutum, and scutellum are demarked by sutures. The prescutum psc_2 and the scutum sc_2 together form a dome-like region. The prescutum occupies the anterior and dorsal extent of this dome-like region and the scutum occupies the remainder. The scutum is divided into an anterior and posterior portion by a transverse scutal suture *ss*. The scutellum sl_2 is lobe-like and is separated from the postscutellum by a membranous area. Sutures divide the postscutellum into a median sclerite or mediotergum mt_2 and two lateral sclerites or pleuroterga pt_2. The pleural suture *c* which extends from the region of the eucoxa ec_2 dorsad to some indefinite point near the base of the wing, divides the mesothoracic pleuron into an episternal and an epimeral region. Cephalad of this suture is the episternum which is divided by the anepisternal suture *a* into a dorsal region, the anepisternum aes_2 and a ventral region, the sternopleurum spl_2. A membranous cleft which extends downward as far as the anepisternal suture *a* splits the anepisternum into an anterior part, which is fused with the sternopleurum, and a posterior part. In *Tanyderus* the membranous cleft is short and broad while in *Macrochile* it is represented only by a suture. The anepisternal suture in both of these genera extends cephalad only as far as this cleft as is the case in *Protoplasa*. The ventral portion of the episternum is fused with the sternum and is termed the sternopleurum spl_2.

The small irregular subalifer *saf* lies between the anepisternum and the anepimeron with its posterior limit demarked by the pleural suture *c*. Close relatives of the Tanyderids (the Psychodids and Ptychopterids) as well as other Tanyderids figured by Crampton (1925a and 1926a) have the subalifer clearly demarked and of the same contour as that of *Protoplasa*. The epimeron is the posterior region of the pleuron and is demarked by the transverse anepimeral suture *b* into a dorsal area or anepimeron aem_2 and a ventral area or meropleurum mpl_2. The meropleurum is formed by the fusion of the meron and the katepimeron. This fusion of the meron with the epimeron to form the meropleurum is characteristic of Nematocerous families Tanyderidæ, Ptychopteridæ and Psychodidæ. No other Nematocera with the exception of the Blepharoceridæ exhibit this condition. Although the sternum of the mesothorax lacks a presternal region, there is a small basisternum lying between the sternopleura and a relatively large furcasternum which separates the eucoxæ. The eucoxa ec_2 alone forms the basal segment of the mesothoracic leg, the meron having fused with the epimeron as mentioned above.

Metathorax. Like the prothorax, the metathorax is greatly reduced. The metanotum mtn_3 is a narrow region extending along the posterior border of the postscutellum of the mesothorax. Dorsad of the episternum of the metathoracic pleural region is the metathoracic spiracle *sp*. The episternum es_3 is reduced to a wedge-shaped sclerite and is demarked from the narrow and elongate epimeron em_3 by a pleural suture. The metasternum is represented in lateral view by a small triangular sclerite labelled st_3. In ventral aspect, however, it is composed of a small basisternum which is faintly demarked and fused with the poorly defined furcasternum caudad of it. The coxæ cx_3 lie at the sides of the furcasternum.

APPENDAGES OF THE THORAX.

The legs of the *Protoplasa* are essentially the same, therefore that of the prothorax has been figured as representative. It is very slender and longer than the body. Fig. 13 shows that the coxa *cx* is of moderate size and that the trochanter *tr* is small. The coxa of the mesothorax differs from the coxæ of the other segments in that it is composed of the eucoxa alone. The femur *fe* and the tibia *ti* of the prothoracic leg are subequal in length. At the distal end of the tibia there are two well developed and moveable spines. The basitarsus *bta* is equal to about three-fourths of the length of the tibia, and like the tibia bears two spines distally. The second tarsal segment is about one-half the length of the basitarsus and bears two spines; the third segment is about one-half the length of the second or preceding one and also bears two spines; while the fourth segment is smaller than the third and has no spines. The distitarsus *dta* or terminal segment bears several spines and two ungues or claws *un.*

The wing of *Protoplasa fitchii* has been figured many times and its venation is recognized as being very primitive. Fig. 13 shows the various distinguishing features interpreted according to Tillyard. With the exception of the supernumerary crossvein of cell M_3 most of the characters are present in Tanyderids in general.

The subcosta is two-branched $Sc_{1,2}$; the radius is five-branched $R_{1,2,3,4,5}$; the media four-branched $M_{1,2,3,4}$; and the cubitus *Cu* has one branch. There are two anals *1st A* and *2nd A*. Cell R_2 is shorter than its petiole and has its base lying beyond the midlength of the distal section of R_1. Cell *1st* M_2 is long, broadened distally and is closed. The two cells beyond are comparatively short. Cell M_3 has a supernumerary crossvein peculiar to *Protoplasa.* Between the cubitus *Cu* and the first anal *1st A* there is an indefinite vein or fold which runs close to *Cu* for about three-fourths of its length and is labelled *pa* in Fig. 12. According to Tillyard this would be Cu_2 but according to Comstock it is *1st A.* Crampton (1926a) calls it the "preanal." The second anal *2nd A* forms the so-called "T" vein characteristic of the Tanyderids as a whole. The radio-medial crossvein *r–m* has what appears to be the stub of a vein at its anterior end. Crampton (1926a) suggests its possible phylogenetic significance. The medial crossvein *m* is always present in the Tanyderids. The humeral *h* and the medio-cubital *m–cu* crossveins are of no particular importance.

The haltere *ha* (Fig. 11) is stalked and knob-like at the end. Basally it is mostly membranous and the stalk is only weakly sclerotized. The distal end is subglobose with a transverse suture or fold which divides it into two distinct hemispherical parts, the dorsal one of which is the larger and overlaps the other. The smaller portion bears three setæ.

ABDOMEN.

The abdomen of *Protoplasa fitchii* has nine distinct segments; the tenth and eleventh are fused and indefinite. Crampton (1926a) has indicated the same condition in *Macrochile,* and in his 1931 publication (Crampton 1931a) the figures show that the primitive Mecopteran, *Notiothauma,* which is closely allied to the Diptera, is strikingly similar. There is a marked "telescoping" of all the segments and this condition tends to make them appear more variable in length than they are actually. Fig. 20 shows that the first, second, and eighth segments are relatively short; the third, fourth, and fifth are intermediate; while the sixth and seventh are the longest. The ninth and the fused tenth and eleventh are indefinite because of their modification. Figs. 16, 19, and 20 show clearly that the first eight segments are composed of a dorsal sclerotized region or tergite *1t* to *8t* separated from the ventral sclerotized area or sternite *1s* to *8s* by a lateral membranous area. In this membrane between the tergite and sternite, the spiracle *sp* of the segment is borne. The first abdominal spiracle, however, is situated more dorsally in the membrane between the metathoracic epimeron and the first abdominal tergite.

In the male there is a strong twisting or torsion of the terminal segments to facilitate mating. Fig. 20 shows this twisted condition as a result of which the tergites of the seventh, eighth, and ninth segments occupy a lateral position instead of being dorsal as they are normally. The male differs from the female in that the ninth segment is the first to show modification. The ninth tergite *9t* which Crampton (1926a) termed the "epandrium" in *Macrochile,* is bilobed (Figs. 18, 19, and 20). In *Macrochile* the lobes are not so pronounced as they are in *Protoplasa.* The cerci *bc* of the male are reduced to one segment. These basicerci, as they are called, lie in the membrane behind the ninth tergite and at the sides of the area which corresponds to the anus-bearing proctiger of *Macrochile.* The basicerci represent the basal portions of the cerci. In *Macrochile* the cerci are likewise one-segmented but the proctiger or anus-bearing structure is more clearly demarked. The gonopods or copulatory limbs are composed of two segments. The basal segment *bst* (Figs. 14, 18, 19, and 20) of the gonopod is variously termed by different authors as basistyle or coxite. As yet it is unsettled whether the basal segments are coxites or merely segments of the style. In *Protoplasa* these so-called coxites or basistyles *bst* are either united basally or fused with adjacent structures such as the ninth sternite, etc., as Crampton suggests in the case of *Macrochile*. The distal portion *dst* of the gonopod variously termed the style, gonostyle, dististyle, or clasper is rather deeply forked in *Protoplasa*, forming a comparatively short basal process *sap* and a longer distal process *ap* which bears a peculiar tuft of spines at the tip of its inner margin. Like *Protoplasa*, *Macrochile* has a forked style or dististyle with an elongate distal process and a rather short basal process. In *Tanyderus* and *Péringueyomyina* the style or dististyle is not forked. It is short in *Tanyderus*, but in *Péringueyomyina* it is very long and slender and has a series of spines along its inner margin. Each coxite or basistyle has on its dorsal surface a weakly sclerotized, lobe-like structure *int* which perhaps corresponds to the interbase (Figs. 14, 17, and 18). The so-called gonapophyses *gap* are probably represented by a pair of elongate projections flanking the aedeagus and having their bases imbedded in the basal region of the coxites or basistyles (Figs. 14, 17, 18, and 19). A sclerotized process *aed* with three prongs shown in Figs. 14, 17, and 18, together with a supporting collar-like portion may represent the aedeagus. This structure lies in the membranous area between the coxites or basistyles and the basicerci. The aedeagus in *Macrochile* is an elongate and bifid structure.

Differentiation of the terminal segments of the female of *Protoplasa* begins in the eighth abdominal sclerite which is not so much reduced as in the male. The eighth sternite *8s* bears a pair of lobe-like projections *vv* but these apparently are not homologous with the structures called the ventral valves in *Macrochile*. There is a small sclerite *ls* between the ninth tergite and the eighth sternite which may possibly be the reduced ninth sternite. In *Protoplasa* there is no structure homologus to the mediogynium or projection between the ventral valves of *Macrochile.* Unlike that of the male, the cercus of the female has two segments, the basicercus *bc* and the disticercus *dc.* Both of these segments are relatively large and rounded. In *Macrochile* the disticercus is reduced to a pointed process and the basicercus is bilobed.

GENERAL ACCOUNT OF THE FAMILY TANYDERIDÆ

The family Tanyderidæ represents a group of the most primitive of all living Diptera. Osten-Sacken (1859, 1869, 1880, 1886) and Philippi (1865) considered that its members belonged to the family Tipulidæ. Handlirsch (1909), however, grouped them with the Ptychopteridæ as the subfamilies Tanyderina and Macrochilina. Enderlein (1912), Alexander (1913), and Riedel (1921) likewise classified them as a subfamily under the Ptychopteridæ. In 1919, Alexander in a key to the crane-flies of Northeastern North America included these flies as a distinct family, the Tanyderidæ, characterized by possession of five branches of the radius which reach the wing margin and by the presence of a single anal vein. Crampton (1926b) showed that because of their close affinities to the Psychodidæ, these primitive flies should be placed in the superfamily Psychodoidea rather than in the Tipuloidea as was formerly the case. Studies of the recently discovered immature stages of *Protoplasa fitchii,* which is considered representative of the family, proved the group to be isolated from either the Psychodidæ or the Ptychopteridæ (Alexander, 1930a; Crampton, 1930a, 1930b). The Bruchomyiinæ which are now placed as a subfamily of the Psychodidæ (Alexander, 1928a; Crampton, 1925a, 1926a; Tonnoir, 1922) were previously considered as representing a subfamily of the Tanyderidæ (Alexander, 1920c, 1927b).

Knowledge of the immature stages of the Tanyderids was lacking until June, 1929, when Alexander (1930a) and Crampton (1930a, 1930b) discovered the larva and pupa of *Protoplasa fitchii* on the Gaspé Peninsula, Quebec. Prior to this time, a unique Dipterous larva from the vicinity of Washington, D. C., described by Alexander (1920c) as the "supposed larva" of *Protoplasa fitchii* was the only immature form considered as possibly representing the family. Because of the recent discovery of the larva and pupa of *Protoplasa fitchii,* students of Diptera are at a loss as to the exact affinities of this "supposed larva."

Phylogeny. The oldest known Tanyderid is the Baltic Amber *Macrochile spectrum* Loew. Crampton (1926a) places this insect at the base of one of the lines of descent of Diptera which leads to the Psychodoids. Handlirsch (1909) derives *Macrochile* from the Archiptychoptera in the latter part of the Cretaceous period and, according to him, from *Macrochile* arise *Protanyderus, Protoplasa, Tanyderus, Radinoderus,* and *Mischoderus* in the Tertiaries. According to Alexander (1932), the Lower Tertiary Etoptychoptera (Handlirsch, 1910) shows certain points of resemblance to *Macrochile* in the nature of the radial and medial fields of the wing but has two anal veins. The Mesozoic Eoptychopteridæ also differ from the Tanyderidæ. Tillyard's *Permotipula* described from the Permian deposits of New South Wales (Tillyard, 1929) shows a highly modified radial field of the wing and indicates that Diptera arose in the Palæozoic era.

Genera. The genera composing the Tanyderidæ number ten living and one fossil. *Macrochile* Loew (1851), the fossil genus, was the first to be described. It is known only from the Lower Oligocene Baltic Amber. For some time Osten-Sacken and Meunier thought this genus to be synonymous with the recent genus *Protoplasa.* In 1859 *Protoplasa* was described by Osten-Sacken. Philippi (1865) defined the genus *Tanyderus* in which most of the known species were placed until Handlirsch (1909) proposed *Protanyderus, Mischoderus,* and *Radinoderus* as new generic groups. Alexander (1927b) regarded these groups proposed by Handlirsch as valid subgenera and added *Neoderus* for the Neotropical *Tanyderus patagonicus* Alexander (1913) and *Nothoderus* for the Australasian *Tanyderus australiensis* (Alexander, 1922). In 1928, however, Alexander (1928b) recognized these subgenera as having full generic rank. *Péringueyomyina* was described by Alexander in 1921 as a new and very striking genus. *Eutanyderus* was described by him in 1928 (Alexander, 1928b) and *Araucoderus* in 1929 (1929b).

The following key to the genera of the Tanyderidæ is a revision of that given by Alexander (1928b).

KEY TO THE GENERA OF THE TANYDERIDÆ

1. Front prolonged into a slender rostrum that is longer than the combined head and thorax, the reduced mouthparts being borne at the extreme apex; wings immaculate; male hypopygium with the styli very elongate. (*Ethiopian:* Cape Colony.)
PÉRINGUEYOMYINA Alexander (Fig. 22)
Front not greatly prolonged, the rostrum relatively short, any elongation that exceeds the head in length being due to the palpi and other mouthparts; wings pictured in all recent species; male hypopygium with the styli short........2
2. Wings immaculate. (*Fossil:* Lower Oligocene, Baltic Amber.)
MACROCHILE Loew. (Fig. 21)
Wings pictured, the pattern usually crossbanded brown and subhyaline...3
3. Wings with the free tip of *Sc* preserved. (*Australasian:* Tasmania.)
NOTHODERUS Alexander (Fig. 28)
Wings with free tip of *Sc* atrophied........4
4. Cervical sclerites shorter than the pronotum, the neck-region short; male hypopygium with the dististyle more or less bifid........5
Cervical sclerites elongate, equal to or exceeding the pronotum, the two together form a conspicuous neck-region; male hypopygium with the dististyle simple, terete........6
5. A supernumerary crossvein in cell M_3 of the wing. (*Eastern Nearctic.*) ....*PROTOPLASA* Osten-Sacken (Fig. 33)
No supernumerary crossveins in any cells of the wing. (*Western Nearctic; Palæarctic.*)—*PROTANYDERUS* Handlirsch (Figs. 30, 31, 32)
6. No supernumerary crossveins in any cells of the wing........7
Supernumerary crossveins in two of the radial cells of the wing........9
7. Wings with a short fusion of veins R_{2+3+4}, basal section of R_5 subequal to this element. (*Australasian:* Pupa, Australia.)
RADINODERUS Handlirsch (Figs. 35, 36, 37)
Wings with R_s before the level of *r–m*, the elements R_{2+3} and R_{4+5} being entirely separate........8
8. Antennæ 15-segmented; cell R_2 of the wings shorter than its petiole. (*Australasian:* Victorian.)........*EUTANYDERUS* Alexander (Fig. 26)
Antennæ 18-segmented; cell R_2 of the wings longer than its petiole. (*Neotropical:* Chile.)........*ARAUCODERUS* Alexander (Fig. 29)
9. Wings without a supernumerary crossvein in cell R_4, these being in cells R_3 and R_5. (*Neotropical:* Patagonia.)
NEODERUS Alexander (Fig. 27)
Wings with supernumerary crossveins in cell R_4........10
10. Wings with supernumerary crossveins in cells R_4 and R_5; a short element R_{2+3+4}. (*Neotropical:* Chile.)......*TANYDERUS* Philippi (Fig. 34)
Wings with supernumerary crossveins in cells R_3 and R_4; R_s forking far before the level of *r–m*, veins R_{2+3} and R_{4+5} distinct. (*Australiasian:* New Zealand.)........*MISCHODERUS* Handlirsch (Figs. 23, 24, 25)

SPECIES OF THE TANYDERIDÆ.

The genus *Araucoderus* contains a single species *A. gloriosus* Alexander (1929b) which is Neotropical from Central Chile (Fig. 29).

Eutanyderus has but one species *E. wilsoni* Alexander (1928b) which is Australasian being found only in the mountains of Victoria, Australia (Fig. 26).

Macrochile is likewise a monotypic genus. *M. spectrum* Loew (1851) was described from the Lower Oligocene Baltic Amber. Fig. 21 is copied from Crampton (1926a).

Mischoderus has five species, all of which are Australasian, being confined to New Zealand. *M. annuliferus* was described by Hutton (1900) (Fig. 24); *M. forcipatus* by Osten-Sacken (1880) (Fig. 23); *M. marginatus* Edwards (1923) and *M. neptunus* Edwards (1923) which may not represent distinct species but merely variations of *M. forcipatus;* and *M. varipes* Edwards (1923) (Fig. 25).

Neoderus has but one species, *N. patagonicus* Alexander (1913) which is Neotropical, occurring only in Patagonia. Fig. 27 is after that of Alexander (1913).

Nothoderus is likewise represented by a single species, *N. australiensis* Alexander (1922) which is Australasian, occurring in the mountains of southern Tasmania (Fig. 28).

Péringueyomyina has one species, *P. barnardi* Alexander (1921), from Cape Colony in the Ethiopian region (Fig. 22).

Protanyderus has four species, all of which are Holarctic. *P. beckeri* Riedel (1920) was taken in Turkestan (Fig. 31); *P. vanduzeei* Alexander (1918) (Fig. 30) and *P. vipio* Osten-Sacken (1877) (Fig. 32) were taken in western North America;

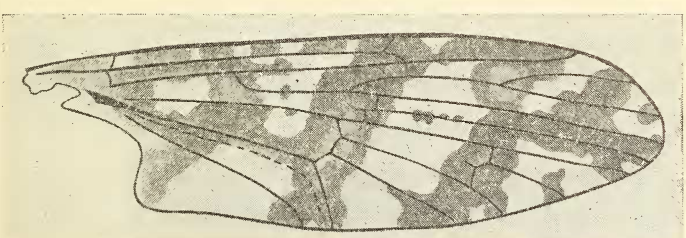

FIGURE 1. Wing of *Protanyderus esakii* Alex.

and the recently described *P. esakii* Alexander (1932) is from Japan.

Protoplasa has a single species, *P. fitchii* Osten-Sacken (1859), occurring in the Eastern Nearctic region (Fig. 33).

Radinoderus includes seven species, all from the Australasian region. *R. dorrigensis* Alexander (1930b) is from northern New South Wales (Fig. 35); *R. mirabilis* De Meijere (1915) is from New Guinea (Fig. 37); *R. occidentalis* Alexander (1925) is from western Australia; *R. oculatus* Riedel (1912) is from New Guinea; *R. ornatissimus* Doleschall (1858) is from Amboina, Obi; *R. solomonis* Alexander (1924) is from the Solomon Islands (Fig. 36); and *R. terræ-reginæ* Alexander (1924) is from Queensland (Fig. 38).

Tanyderus as now restricted is represented by a single species, *T. pictus* Philippi (1865), which is Neotropical, being found only in Central Chile.

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ABBREVIATIONS

a —anepisternal suture
aed —aedeagus
aem —anepimeron
aes —anepisternum
anf —antennifer
ap —apical or outer process
apn —antepronotum

b —anepimeral suture
bc —basicercus
bl —basilabellum
bp —basipharynx
bst —basistyle
bta —basitarsus

c —pleural suture
ce —head bearing process (cephaliger) of the lateral cervical plate
cu —cornua
cx —coxa

dc —disticercus
dl —distilabellum
dst —dististyle (claspers)
dta —distitarsus

e —compound eye
ec —eucoxa
em —epimeron
ep —epipharynx
es —episternum

fc —frontoclypeus
fe —femur
fl —flagellum

ga —galea
gap —gonapophysis (paramere)
ge —gena
gp —gular pit

ha —haltere
hp —hypopharynx

int —interbase

l —labrum
lbl —labellum
lc —lateral cervical plate (laterocervicale)
lcf —laterocervical fenestræ
ls —? 9th sternite

mn —mentum
mpl —meropleurum
mt —mediotergum
mtn —metanotum
mxp —maxillary palp

occ —occipital condyle
ocp —occiput
oes —oesophagus
of —occipital foramen

pd —occipital condyle
pfr —palpifer
pge —postgena
pgr —palpiger
pn —pronotum
ppd —postpedicel
ppn —postpronotum
psc —prescutum
pt —postalare or pleurotergum

s —sternite
saf —subalifer
sal —subalare
sap —basal process of dististyle
sc —scutum
sca —scape
sd —salivary duct
sl —scutellum
sp —spiracle
spl —sternopleurum or katepisternum
ss —scutal suture

st —sternum
sti —stipes

t —tergite
th —thickening
ti —tibia
tnt —tentorium
to —tormae
tr —trochanter

un —ungues or claws

v —vertex
vv —lobes of 8th sternite of female

1st A —first anal
2nd A—second anal
C —costa
Cu —cubitus
h —humeral crossvein
m —medial crossvein
M_1 —1st branch of media
M_2 —2nd branch of media
M_3 —3rd branch of media
M_4 —4th branch of media
m–cu —medio-cubital crossvein
pa —"preanal vein"
R_1 —1st branch of radius
R_2 —2nd branch of radius
R_3 —3rd branch of radius
R_4 —4th branch of radius
R_5 —5th branch of radius
R_s —radial sector
r–m —radio-medial crossvein
Sc_1 —1st branch of subcosta
Sc_2 —2nd branch of subcosta

PLATE I

Fig. 1—Dorsal view of the head
Fig. 2—Lateral view of the head
Fig. 3—Head with dorsal portion removed to show tentorium
Fig. 4—Caudal view of the head
Fig. 5—Epipharynx
Fig. 6—Ventral view of the head
Fig. 7—Antenna
Fig. 8—Hypopharynx
Fig. 9—Labium and maxillæ

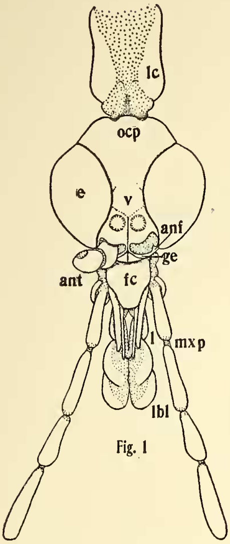


Fig. 1

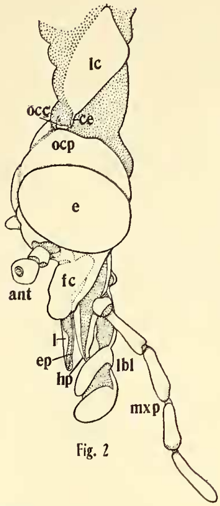


Fig. 2

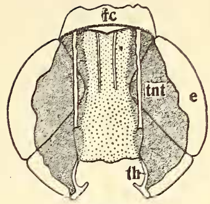
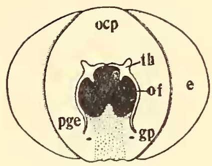


Fig. 3



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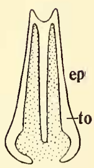


Fig. 5

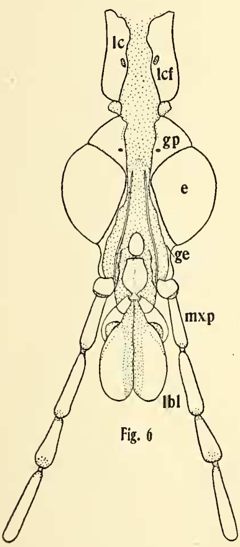
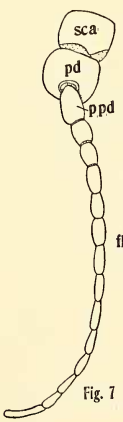


Fig. 6



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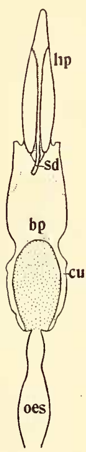


Fig. 8

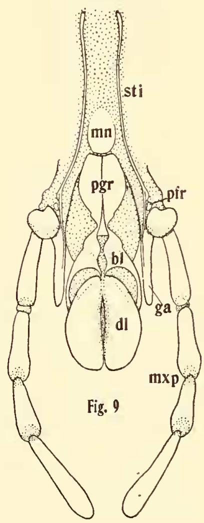


Fig. 9

TANYDERIDÆ

PLATE II

Fig. 10—Lateral view of the thorax
Fig. 11—Haltere
Fig. 12—Wing
Fig. 13—Prothoracic leg of male

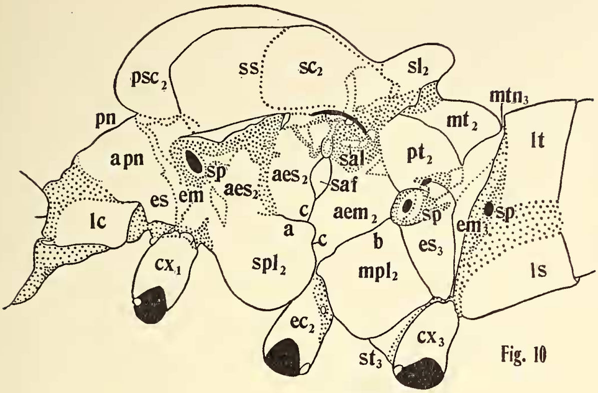


Fig. 10

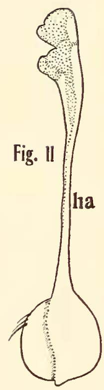


Fig. 11

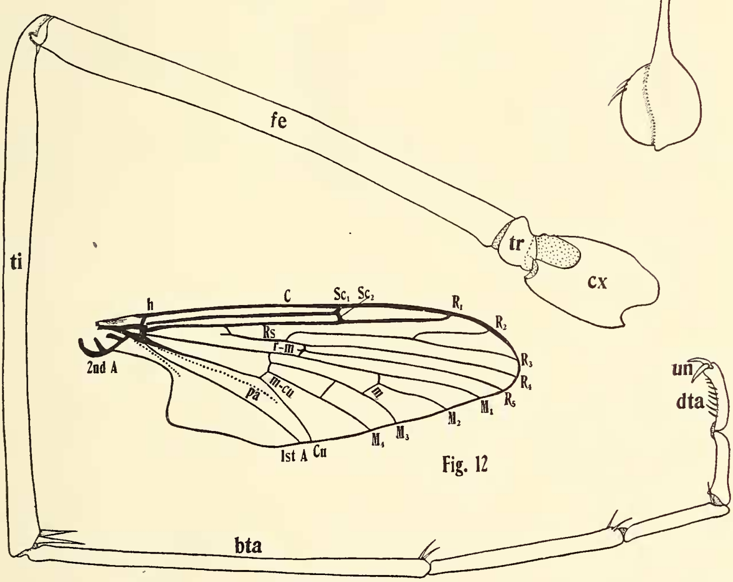


Fig. 12

Fig. 13

TANYDERIDÆ

PLATE III

Fig. 14—Ventral view of the terminal abdominal structures of the male
Fig. 15—Ventral view of the terminal abdominal structures of the female
Fig. 16—Lateral view of the terminal abdominal structures of the female
Fig. 17—Dorso-caudal view of the terminal abdominal structures of the male
Fig. 18—Dorsal view of the terminal abdominal structures of the male
Fig. 19—Lateral view of the terminal abdominal structures of the male
Fig. 20—Lateral view of the abdomen of the male

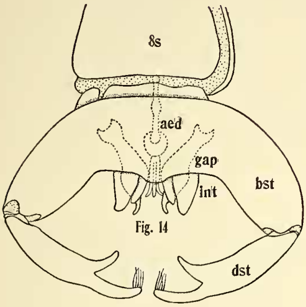


Fig. 14

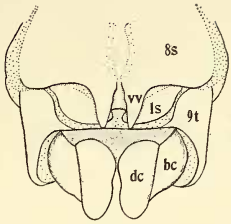


Fig. 15

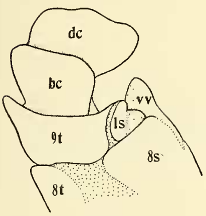


Fig. 16

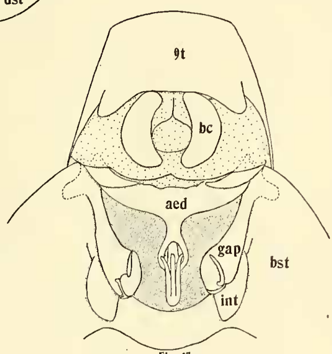


Fig. 17

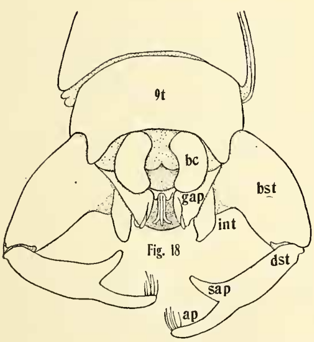


Fig. 18

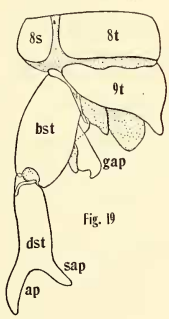


Fig. 19

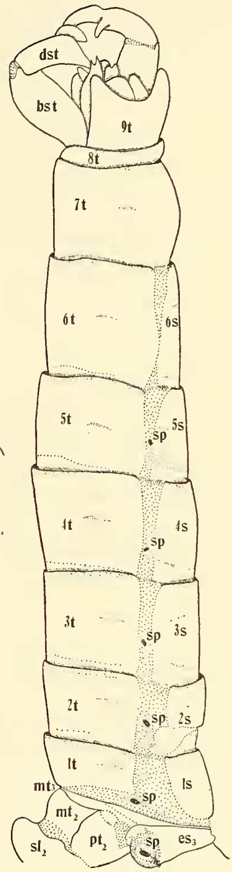


Fig. 20

TANYDERIDÆ

PLATE IV

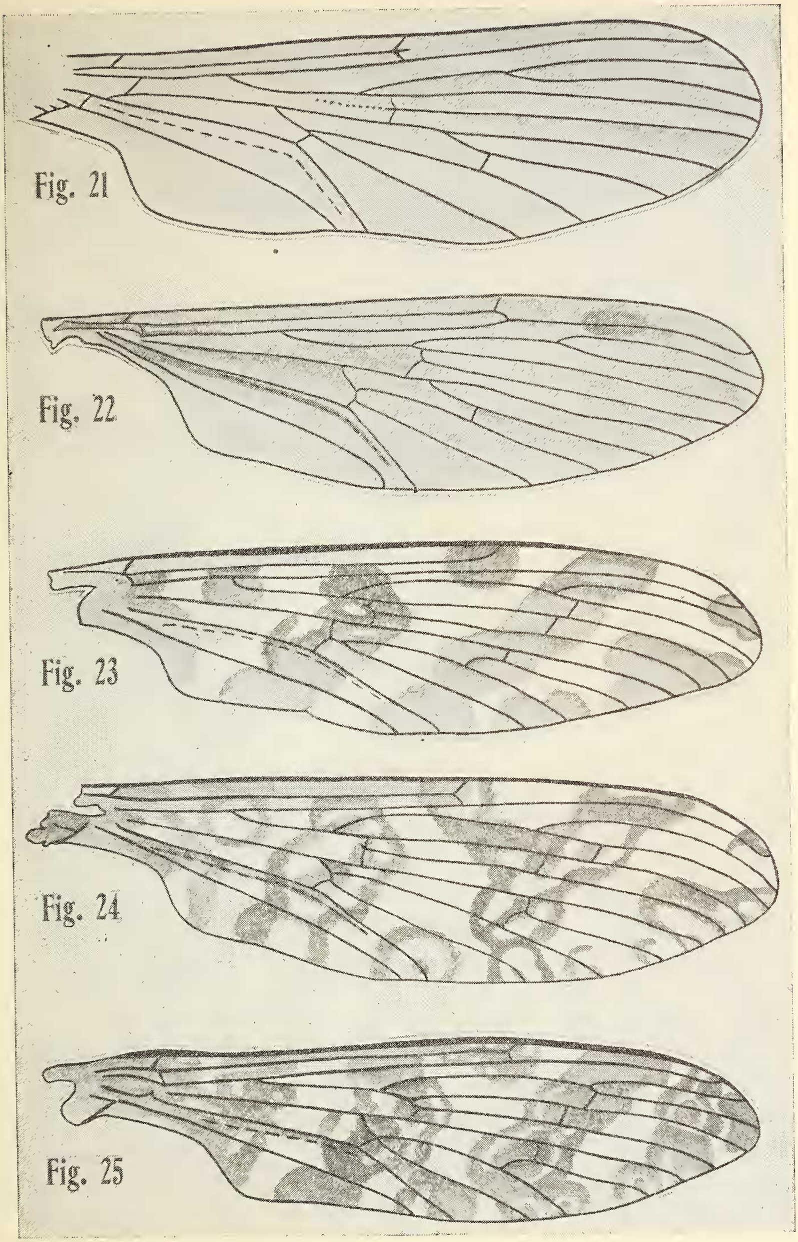
Fig. 21—Wing of *Macrochile spectrum* Loew (copied from Crampton's figure)

Fig. 22—Wing of *Péringueyomyina barnardi* Alex.

Fig. 23—Wing of *Mischoderus forcipatus* O. S.

Fig. 24—Wing of *Mischoderus annuliferus* Hutt.

Fig. 25—Wing of *Mischoderus varipes* Edw.



TANYDERIDÆ

PLATE V

Fig. 26—Wing of *Eutanyderus wilsoni* Alex.
Fig. 27—Wing of *Neoderus patagonicus* Alex. (after Alexander)
Fig. 28—Wing of *Nothoderus australiensis* Alex.
Fig. 29—Wing of *Araucoderus gloriosus* Alex.

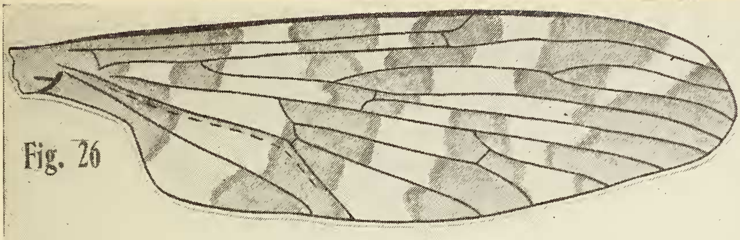


Fig. 26

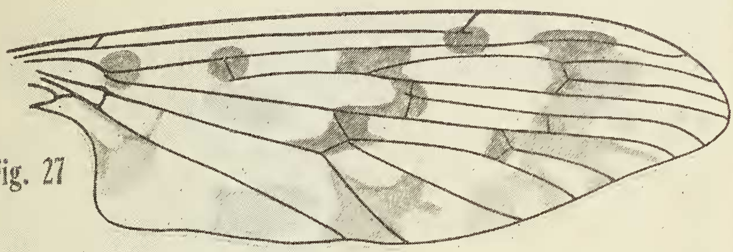


Fig. 27

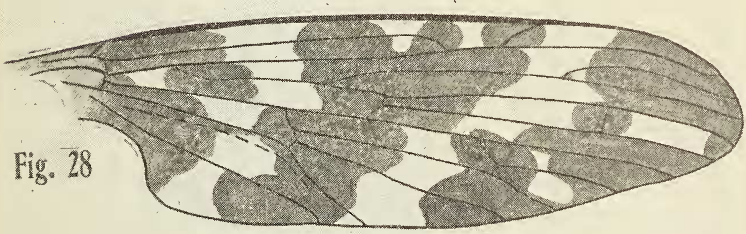


Fig. 28

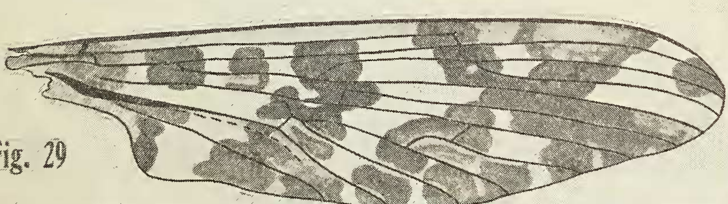


Fig. 29

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PLATE VI

Fig. 30—Wing of *Protanyderus vanduzeei* Alex.
Fig. 31—Wing of *Protanyderus beckeri* Riedel.
Fig. 32—Wing of *Protanyderus vipio* O. S.
Fig. 33—Wing of *Protoplasa fitchii* O. S.

Fig. 30

Fig. 31

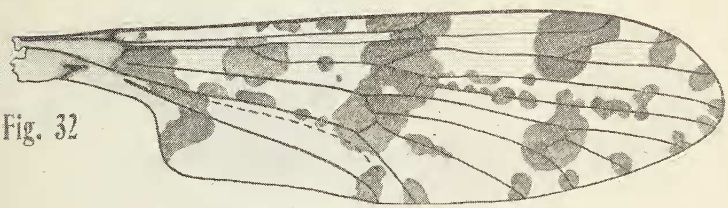

Fig. 32

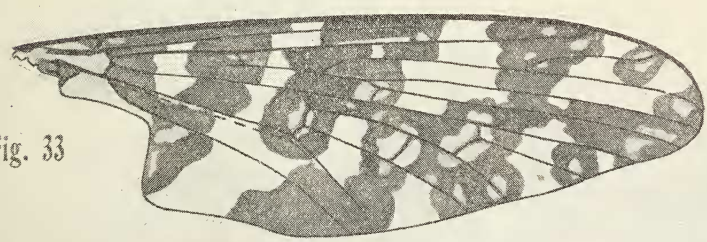

Fig. 33

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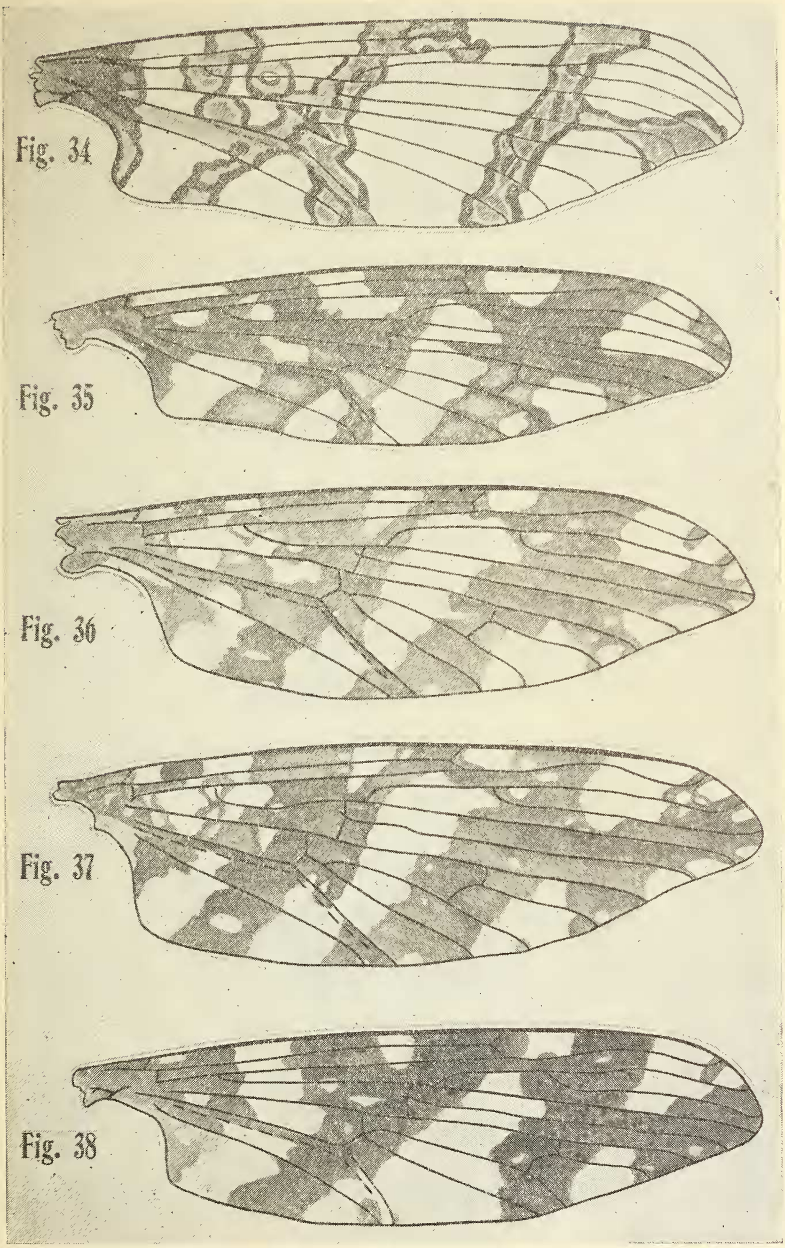
PLATE VII

Fig. 34—Wing of *Tanyderus pictus* Phil.
Fig. 35—Wing of *Radinoderus dorrigensis* Alex.
Fig. 36—Wing of *Radinoderus solomonis* Alex.
Fig. 37—Wing of *Radinoderus mirabilis* De Meij.
Fig. 38—Wing of *Radinoderus terræ-reginæ* Alex.



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